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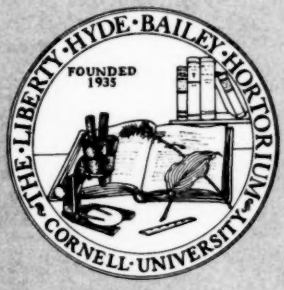

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Identification of the Cultivated Passionflowers

George H. M. Lawrence[1]

Few flowers are more exotic in appearance than the passionflowers, and few have become so closely linked with legend and myth through an unusual morphology. The association of the passionflower with the Passion of Christ comes to us from the Spanish, whose early missionaries knew the plant in the New World tropics and associated the floral parts with religious symbolism of the crucifixion. This has been described in detail by Folkard (Plant lore, legends, and lyrics, 1884), and summarized by Bailey (Standard Cyclopedia of Horticulture, p. 2480, 1916). The plants are grown in the United States largely for their showy flowers, but even here and in most tropical regions certain species (e.g., P. quadrangularis, P. edulis, and P. laurifolia) are grown primarily for their edible fruits, the pulp of which provides delicious and aromatic cooling beverages and sherbets. Many of the species are highly susceptible to nematode infection, a condition to be guarded against and which often is responsible for failure of the species to grow successfully.

The genus contains about 400 species, largely tropical American in distribution but with perhaps 50 species in southeast Asia and Australia, and 7 native in the continental United States. About 30 species are currently or have recently been available in the American trade.

The structure of the flower is so complex as to require explanation of the organs and the special terms assigned to them. These are identified in Fig. 52, which illustrates the very commonly grown hybrid, P. × alato-caerulea. Though each species will show some modification of the organs as they are represented here, and in some species certain of the organ-series may be missing, P. × alato-caerulea is rather typical of most cultivated species and hybrids.

Observed in face view, the flower is seen to consist of five sepals and five petals. These are fused at their bases, however, into a tube varying in length from 2 mm. to nearly 1 dm. This tube is properly termed an hypanthium. (Those species with a long cylindrical hypanthium - referred to as a calyx-tube in much of the literature - were formerly separated as a distinct genus called Tacsonia, but today are considered members of the genus Passiflora.)

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Arising from the apparent base of the petals, and at the mouth of the hypanthium, is a usually fringe-like crown called the corona, composed of one to six rows of filamentous structures, and usually conspicuously banded with contrasting colors. At the mouth of the flower is a delicate membrane, the operculum, which is sometimes pleated (plicate) or fringed (fimbriate) to varying degrees. Within the operculum is the narrow nectar ring, though this is lacking in some species. Innermost of these ring-like appendages is the limen, varying from a thin and narrow membrane to one fleshy and cup-like. These various appendages are believed to represent enations (out-growths) from the perianth, and are not staminodia (sterile stamens). The number of rows (ranks or series) composing the corona provides a good character for species identification, as do also the types of operculum and limen that are present.

The essential organs of the flower (stamens and pistil) are also complex. Although encircled by the hypanthium, the ovary of the flower is superior - that is, it is above the point of attachment of the hypanthium. In most species the ovary is raised above the floor of the hypanthium on a stalk called the gynophore; the five stamens seem to spring from the top of this gynophore, also, just below the ovary, for the lower parts of the stamen-filaments are united in a tube which, in turn, is closely adherent to the gynophore. The three styles arise separately and directly from the top of the ovary or may be united for a very short distance basally.

Vegetative characters are often useful as aids in identifying species of passionflowers. In some species the stems are round in cross-section (terete), but in others they are sharply angled or the angles are produced into short or large wings. This character should be observed at a point near the base of the current growth, several internodes behind the tip of the stem, since the internodes of the youngest growth may be angular whereas those farther back along the stem are terete. Glands are present on the petioles of most species, and when they are absent, this is of itself a distinctive character. These petiolar glands may be merely small protuberances or they may be well-developed but tiny club-like structures (then said to be stipitate). The leaves may be variously lobed or unlobed. The depth of lobing is often diagnostic; the midvein of each lateral lobe may form a narrow and acute angle with the midvein of the central lobe, or the angle so formed may be wide. Stipules are usually present at the nodes of the stem and are usually either narrowly linear to thread-like or setaceous, or broadly ovate and distinctly leaf-like. In no case, however, do the stipules become large, and rarely do they exceed 2 cm. in length (much shorter when setaceous). Sometimes the stipules fall from the node as the leaf matures (early deciduous), and their presence and form should be studied at the nodes of the young growth. In one species (P. foetida), the stipules are deeply divided or cleft into lateral thread-like segments.

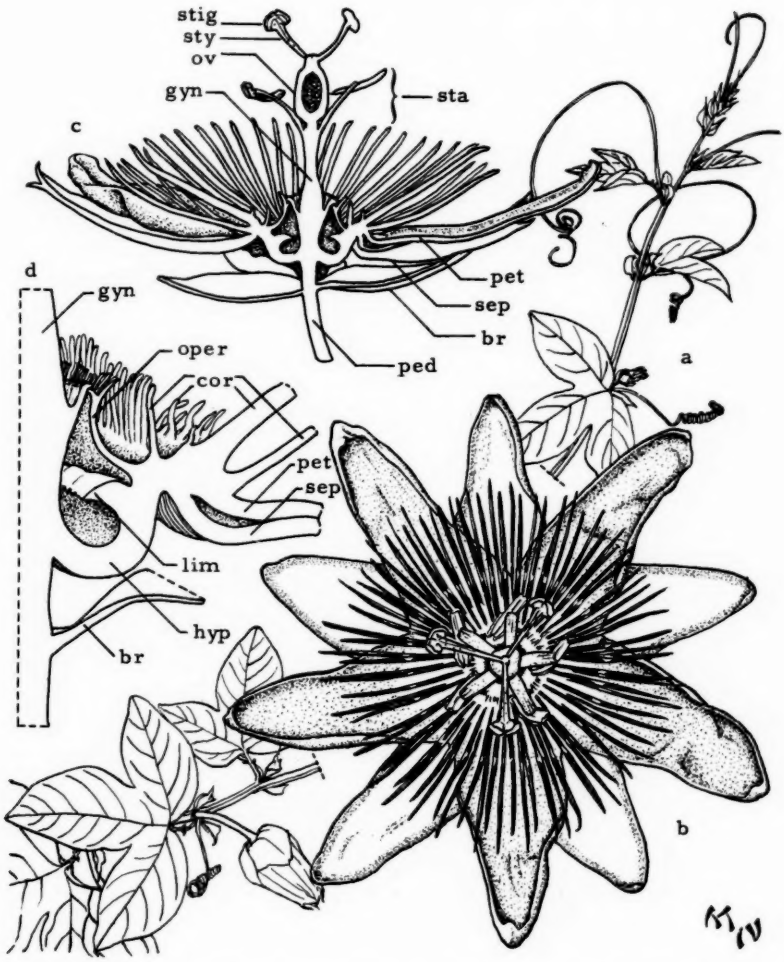

Fig. 52. Passiflora × alato-caerulea: a, terminal portion of a stem x 2/5; b, flower, face view x 1; c, flower in vertical section x 1; d, base of center of flower in vertical section x 3. (br = bract, cor = corona, gyn = gynophore, hyp = hypanthium, lim = limen, oper = operculum, ov = ovary, ped = pedicel, pet = petal, sep = sepal, sta = stamen, stig = stigma, sty = style).

Each flower is usually subtended by 3-5 green bracts. These may be close against the calyx and appear to form a second calyx, or they may arise almost anywhere along the peduncle and be several centimeters below the flower. When well below the calyx they are usually scattered and not in close proximity to one another. In form they may be small and almost thread-like, or large and sepal-like. In some species, these bracts and the sepals are shallowly and remotely toothed, with the tips of each tooth tipped with a sessile dark-colored gland. In others, the bract-margins are basally fused to form a short cup or cylinder.

The most recent monograph of the genus is that by Ellsworth P. Killip ("The American species of Passifloraceae." Field Museum of Natural History. Botanical Series. 19: 1-613, 1938), but its scope does not include the Old World species, of which at least 3 are currently cultivated in America. Because of the increasing popularity of these plants in American gardens, and the uncertainty that exists among many growers as to the identity of plants they possess, the following key is provided to the cultivated species and to the more commonly grown hybrids. The key must be considered provisional, since for many of its included species it has been tested only with a few specimens or collections, and, in a few instances where these were lacking, the distinguishing characters have been taken from Killip's monograph. Persons finding areas of error or weakness in the key are invited to advise me of them.

Key to the Cultivated Species of Passiflora

1. Flowers usually less than 4 cm. across, usually greenish or whitish; corona 1-2-ranked; operculum generally plicate and without a row of filaments between it and the corona.
   2. Petioles bearing sessile or stipitate glands.
      3. Petals present, but sometimes only 4-5 mm. long.
         4. Ovary glabrous; petals 4-5 mm. long and setaceous. . 1. P. bryonioides
         4. Ovary densely pilose; petals 6-10 mm. long and linear to lanceolate-oblong.
            5. Leaves lobed to well below the middle, the central lobe narrowed at base. . . . . 2. P. morifolia
            5. Leaves lobed to above the middle, the central lobe not narrowed at base. . . . . 3. P. Warmingii
      3. Petals absent.
         6. Sepals white within; petiolar glands 4-5 and stipitate; leaves not peltate. . . . . 4. P. gracilis
         6. Sepals green within; petiolar glands 2 (rarely 4) and sessile; leaves peltate.
            7. Leaves unlobed, broader than long; calyx-tube (hypanthium) broadly campanulate, 4-5 mm. long. . . . . 5. P. coriacea

7. Leaves 3-lobed; calyx-tube (hypanthium) cylindric and about 1.2 cm. long. . . . . 6. P. viridiflora

2. Petioles without glands.

8. Bracts absent from peduncle. . . . . 7. P. lutea

8. Bracts present (subtending the perianth).

9. Corona 1-ranked. . . . . 8. P. organensis

9. Corona 2-ranked.

10. Leaves mottled white or yellowish-green along veins above, reddish to violet beneath, always 3-lobed; sepals and petals pale green within. . . . . 9. P. trifasciata

10. Leaves green on both sides, varying in form from transversely oblong to peltate or 2-lobed (rarely 3-lobed); sepals and petals white within. . . . . 10. P. biflora

1. Flowers usually more than 5 cm. across, highly colored; corona in more than 2 series; operculum with a row of filaments between it and the corona.

11. Calyx-tube (hypanthium) cylindric, longer than the sepals.

12. Bracts free to base, usually serrate to lacerate. . . . . 11. P. Jamesonii

12. Bracts united, at least at the base and usually to the middle, usually entire.

13. Stems distinctly angular; petioles with 4-8 stipitate glands; petals pink to orange-red, white at base. . . . . 12. P. mixta

13. Stems terete (young shoots sometimes weakly angled); petioles with 8-12 sessile glands.

14. Petals 2.5-3.5 cm. long, greenish outside and pink inside; leaves lobed to 2/3 their length. . . . . 13. P. mollissima

14. Petals 4.0-6.5 cm. long, brick-red outside and pink inside; leaves lobed nearly to base. . . . . 14. P. exoniensis

11. Calyx-tube (hypanthium) usually urceolate-campanulate (cylindrical in no. 17), shorter than the sepals.

15. Flowers in racemes which are usually 3 dm. long or more. . . . . 15. P. racemosa

15. Flowers solitary or in pairs in the leaf-axils.

16. The flowers in shades of vermilion-red to scarlet, the sepals and petals nearly uniform in color.

17. Peduncles less than 8 cm. long. . . . . 16. P. manicata

17. Peduncles more than 10 cm. long.

18. Calyx-tube (hypanthium) 2.5-5.0 cm. long. . . . . 17. P. antioquiensis

18. Calyx-tube (hypanthium) 8-20 mm. long.

19. Leaves without raised or stipitate glands on petioles. . . . . 18. P. cinnabarina

19. Leaves with 2-4 raised or stipitate glands on petioles.

20. Sepals and petals acute; leaves unlobed. . . . . 19. P. coccinea

20. Sepals and petals obtuse; leaves 3-lobed. . . . . 20. P. vitifolia

16. The flowers white or green, or in shades of rose-pink or bluish-purple, or, if the petals are scarlet or vermilion, the sepals are not so.

21. Stems quadrangular, the angles acutely and weakly to strongly winged.

22. Leaves 3-lobed; the sepals white within. . . . . 21. P. alato-caerulea

22. Leaves not lobed; the sepals usually pink, crimson, or purple within.

23. Petioles 6-glandular; nerves of leaves 10 or more on a side; stipules ovate to lanceolate. . . . . 22. P. quadrangularis

23. Petioles 2-4-glandular; nerves of leaves about 8 on a side; stipules linear to linear-lanceolate. . . . . 23. P. alata

21. Stems terete or angular, but the angles not winged.

24. Bracts united, at least at base; leaves unlobed.

25. Petiole-glands stipitate and 3 mm. long or more; the petals white or pinkish-white. . . . . 24. P. ligularis

25. Petiole-glands subsessile and flattened; the petals green, densely mottled with reddish-purple. . . . . 25. P. maliformis

24. Bracts separate to base, not united; leaves usually lobed (but unlobed in no. 26).

26. Stipules linear to setaceous, often early-deciduous.

27. Leaves unlobed. . . . . 26. P. laurifolia

27. Leaves 3-7-lobed, or palmately compound.

28. Bracts 1 cm. long or more; leaves glossy above. . . . . 27. P. edulis

28. Bracts less than 1 cm. long; leaves dull above.

29. Plants minutely pilose; leaf-blades mostly 10 cm. long or more, the lobes toothed. . . . . 28. P. incarnata

29. Plants glabrous; leaf-blades mostly 4-8 cm. long, the lobes entire. . . . . 29. P. Banksii

26. Stipules leaf-like, ovate to oblong or reniform.

30. The stipules deeply cleft into filiform or pinnatisect divisions. . . . . 30. P. foetida

30. The stipules entire or only toothed.

31. Leaves predominantly deeply 5-9-lobed, sometimes 3-lobed.

32. The leaves lobed to below the middle (lobes mostly 5-9); petals varying from white to pink, not spotted. . . . . 31. P. caerulea

32. The leaves lobed to above the middle (lobes mostly 3-5); petals white with reddish-brown spots. . . . . 32. P. Colvillii

31. Leaves entire or 3-lobed (never 5-9-lobed).

33. Blades of leaves not lobed, or rarely some may be 2-3-lobed; sepals white, petals white but tinged pink. . . . . 33. P. Oerstedii

33. Blades of leaves quite consistently 3-lobed.

34. Ovary villous-tomentose; flowers in shades of blue, violet, and purple. . . . . 34. P. violacea

34. Ovary glabrous; flowers white.

35. Petioles with 2-4 minute stipitate glands. . . . . 35. P. subpeltata

35. Petioles with 6-8 stipitate glands. . . . . .36. P. Eichleriana

alata. This species is not known to have been offered in the American trade for several decades until Harry E. Saier (Dimondale, Michigan) offered seed of it in 1958. It differs from P. quadrangularis in its petioles' usually having four sessile orbicular glands and in the sepals' and petals' both being rather uniformly carmine-crimson inside (the petals white on the exterior). The species has served conspicuously in Europe as one parent of a number of showy hybrids. It is not known to be currently in the commercial trade in Europe.

× alato-caerulea. This hybrid is readily distinguished from P. alata by its 3-lobed leaves (5-lobed in its other parent, P. caerulea). Although many cultivars have been selected from it and grown under fancy names in the past, none is known to be domestically available at present. The hybrid itself is currently offered by seven American firms. Some of the material so distributed appears to be P. caerulea, and not this hybrid of it.

antioquiensis belongs to the group of passionflowers known as Tacsonia, distinguished by the long cylindrical hypanthium from which the sepal and petal segments arise. Unfortunately, these are seldom grown, though they deserve wider publicity and use. This species is described and illustrated in the older garden literature under the synonym of Passiflora (Tacsonia) Van-Volxemii. It is offered currently in the U. S. A. only by Saier, and in England by Thompson and Morgan, Ltd. It is a spectacular plant in flower, with its pendant bright rose-red blossoms.

caerulea is one of the more hardy species, and one which can readily be brought to flower while growing in a 4-inch pot. It is one of three commonly cultivated species with predominantly 5-9-lobed leaves and blue-violet to purple flowers. Another of these, often confused with it, is P. edulis, a species readily distinguished by its linear to setaceous stipules (ovate and leaf-like in P. caerulea). The third, also with very small stipules, is P. incarnata. In P. incarnata, however, the sepals are lanceolate and 2-3 cm. long (oblong, and 3-4 cm. long in P. edulis), and the corona-filaments are generally pink to purple (white with purple base in P. edulis).

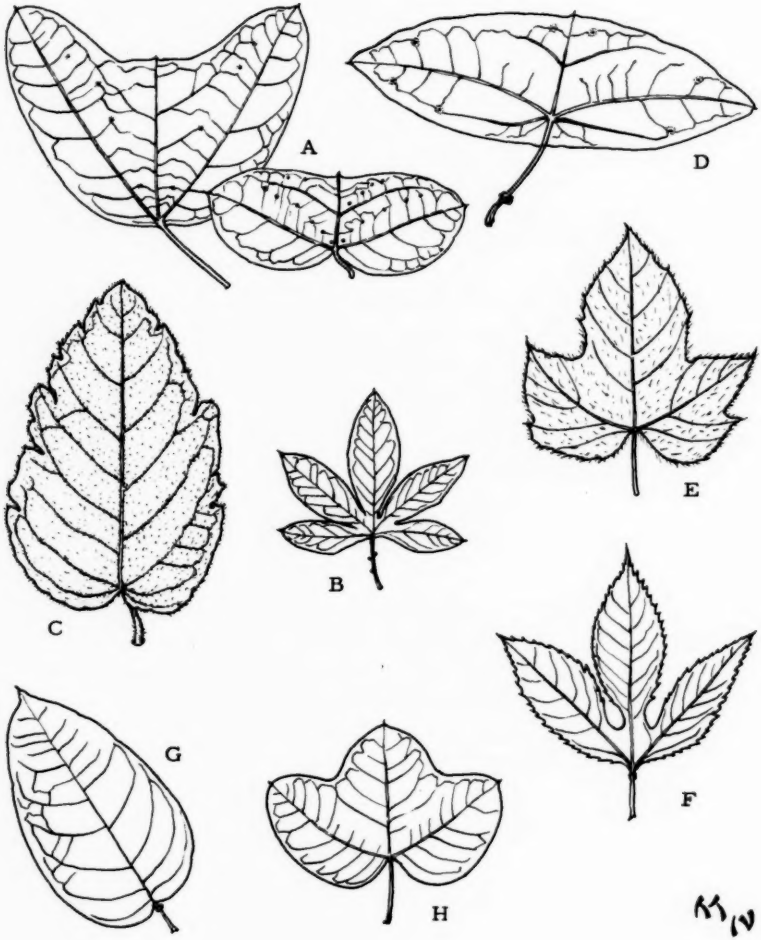

Fig. 53. Leaves of some Passiflora species, all x 2/5: A, P. biflora (two variations). B, P. caerulea. C, P. coccinea. D, P. coriacea. E. P. foetida. F, P. incarnata. G, P. laurifolia. H, P. lutea. These are representative, but there is often great variation possible within one species.

Two cultivars of P. caerulea (possibly of hybrid ancestry) are 'Grandiflora' with flowers 12-20 cm. across, and the British 'Constance Elliott' with white sepals and white corona. Plants of 'Grandiflora' have been offered in recent years as P. grandiflora by Merry Gardens (Camden, Maine) and Logee Greenhouses (Danielson, Connecticut).

P. cinnabarina is one of the few cultivated passionflower vines with leaf-petioles lacking the usually characteristic glands. It is further distinguished by its corona's being yellow in color. Unlike the others of this alliance, it is a native of Australia. It is available in this country from Pearce Seed Company (Moorestown, N. J.) and Barrington Greenhouses (Barrington, N. J.). Seed is currently offered by Thompson & Morgan, Ltd., Ipswich, England.

coccinea. The four red-, scarlet-, or vermilion-flowered passifloras include this species and P. cinnabarina, P. manicata, and P. vitifolia. They are distinguished also by both the petals' and sepals' being of the same or similar shade of color.

P. coccinea, native from Venezuela to Bolivia, was grown here a half-century or more ago, and then was lost to cultivation until recently reintroduced by Ira S. Nelson of the Southwestern Louisiana Institute at Lafayette. This more recent stock he found in Bolivia. Among the four, it is most closely related to P. vitifolia, a species widely distributed from Nicaragua to Peru (but not known from Bolivia) and which has symmetrically 3-lobed leaves (oblong and unlobed in P. coccinea); in both species the bracts are glandular-serrate, but in P. coccinea they are red or orange-red in color. Plants of P. coccinea are currently offered by Grandview Nursery, Youngsville, Louisiana.

coriacea is an oddity among passifloras, since it is one of three cultivated species whose flowers have no petals (see nos. 4, 5, and 6 in the key). The flowers are greenish in color, small, and not particularly showy. It is available from Logee Greenhouses, Grandview Nursery, and Roehrs Greenhouses (Rutherford, N. J.). The related P. gracilis is known in this country only in private collections, but seed of it is listed by a score or more of European botanic gardens. Seed of P. viridiflora was offered in 1958 by the Armchair Explorers (Fullerton, California).

laurifolia, the yellow granadilla or water-lemon, distinguished by its purple-red flowers with the corona banded in blue, purple, and rose (as in the caerulea group), has setaceous stipules that drop off early, and unlobed ovate-oblong leaves with entire margins. Its foliage resembles that of the true granadilla (P. ligularis), but in the latter the bracts are basally connate (distinct in P. laurifolia) and the petals are white tinged with pink. Both are grown for their fruit, used as flavoring in beverages and ices. Neither is known to

be available commercially at present, but both have been in the domestic trade within the last ten years and are presumed to be in gardens, mostly in Florida.

manicata is the species that disproves the distinctness of the Tacsonia group from the more common granadilla-type of passion-flower, for, though it has the long hypanthium (calyx-tube) of the former, it has other technical floral characters of the latter. The short flower-stalk (4-7 cm. long), the blue corona, and the petioles with 4-10 stipitate or subsessile glands compose its diagnostic features. The species was offered by numerous California firms between 1942 and 1953, but none is known to offer it at present. We have no record of its having been offered in Europe since 1932.

morifolia is another of the greenish-flowered species (see discussion under P. coriacea, above), but in a group whose petals are present, though small and usually not conspicuous (in the P. coriacea group the petals are lacking). The two other cultivated species of this alliance are P. bryonioides and P. Warmingii. In P. bryonioides, the petals are linear to filiform and are white. The species is currently offered by several domestic firms (including Saier and the Pearce Seed Co.). Confusion in identification is more likely to exist between the other two species, both of which have short oblong to lanceolate petals. Some of the material passing as P. Warmingii appears to match P. morifolia more closely in foliage and general flower structure, except that the petals lack the purple speckles that usually are present in P. morifolia. Neither is currently available commercially in the country; both are known only in private collections.

× Pfordtii. Amazingly, this name continues to appear in the lists of American firms, although no creditable horticultural or botanical reference work has accepted it as a correct name for well over a half-century. The name is a synonym of P. × alato-caerulea (for discussion, see Baileya 8: 120, 1960).

subpeltata (P. alba). The German botanists Link and Otto in 1828 described under the name P. alba a Mexican white-flowered species that Ortega earlier, in 1798, had named P. subpeltata. The two names were treated as representing separate species until Killip's monograph of the New World kinds was published in 1938. He reports that Ortega's plant was grown from seed collected by Sessé in Mexico, and that the two kinds are so similar as to be inseparable. Passiflora subpeltata, including plants passing in the trade as P. alba, is easily confused with P. Eichleriana but, in addition to the petiolar gland distinction mentioned in the key, differs also from the latter in that the operculum is membranous, with a finely toothed or very shallowly fringed margin. In P. Eichleriana the operculum is deeply filamentous with filaments much longer than the supporting membrane.

Fig. 54. Leaves of some Passiflora species, all x 2/5: A, P. mollissima. B, P. quadrangularis. C, P. racemosa. D, P. trifasciata. E, P. vitifolia. F, P. Warmingii.

Appended below is a finding list of names of species and hybrids known to be cultivated at present in the United States. The valid names are underscored, synonyms and other invalid names are not. Numbers refer to their sequence in the key.

alata Dryander (23)
alba Link & Otto = P. subpeltata
×alato-caerulea Lindley (21)
×Allardii Allard [not in the key]
antioquiensis Karsten (17)
Banksii Bentham (29)
biflora Lamarck (10)
bryonioides Humboldt, Bonpland, and Kunth (1)
caerulea Linnaeus (31)
cinnabarina Lindley (18)
coccinea Aublet (19)
×Colvillii Sweet (32)
coriacea de Jussieu (5)
edulis Sims (27)
Eichleriana Masters (36)
× exoniensis L. H. Bailey (14)
foetida Linnaeus (30)
gracilis Jacquin ex Link (4)
grandiflora = P. caerulea cv.
incarnata Linnaeus (28)
Jamesonii (Masters) L. H. Bailey (11)
laurifolia Linnaeus (26)
ligularis de Jussieu (24)
lutea Linnaeus (7)
macrocarpa Masters = P. quadrangularis
maculifolia Masters = P. organensis

maliformis Linnaeus (25)
manicata (de Jussieu) Persoon (16)
mixta Linnaeus filius (12)
mollissima (Humboldt, Bonpland, and Kunth) L. H. Bailey (13)
morifolia Masters (2)
Oerstedii Masters (33)
organensis Gardner (8)
×Pfordtii Hort. = P. ×alato-caerulea
princeps Loddiges = P. racemosa
quadrangularis Linnaeus (22)
racemosa Brotero (15)
subpeltata Ortega (35)
trifasciata Lemaire (9)
violacea Vellozo (34)
viridiflora Cavanilles (6)
vitifolia Humboldt, Bonpland, and Kunth (20)
Warmingii Masters (3)

Griffinia Rochae, a New Amaryllid Species

Georges M. Morel[1]

While trying to introduce again the lovely Griffinia hyacinthina, which has become very rare in cultivation, I received from Brasil, last winter, some bulbs of a plant very different from any species so far described. This plant had been collected by Mr. Severo Rocha, near Xelem (Province of Rio).

The genus Griffinia was founded by Ker-Gawler in 1820, with Griffinia hyacinthina (Ker-Gawler) Ker-Gawler as the type. The species of this genus were revised in 1949 by H. P. Traub and H. N. Moldenke. In that revision, the genus was divided into two subgenera:

1. Subgenus Eugriffinia [now, correctly, subgenus Griffinia -Ed.], characterized by six functional stamens and petiolate leaves;

2. Subgenus Libonanthe, with five functional stamens and sessile leaves.

This division appears to be rather artificial, since our present species does not fit in either of these subgenera but is just intermediate. The leaves are petiolate, looking very much like the leaves of G. parviflora, but the flower bears only five functional stamens.

Griffinia Rochae G. M. Morel, sp. nov.

Planta glabra, 20-25 cm. alta. Bulbus tunicatus, sphaericus, 3 cm. diam., tunica exteriore tenuissima. Folia 3-4, ovato-lanceolata supra plana, in petiolos canaliculatos attenuata, ad 16 cm. longa, 4 cm. lata. Pedunculus teres subcompressus 18-20 cm. longus, spatha arida persistente 2 cm. longa, umbella 6-8-flora, pedicellis primum ascendentibus deinde reflexis, 1 cm. longis. Perianthium lilacino-violaceum 3 cm. longum, tubo brevi, segmentis 5 labium superius constituentibus, altero porrectiore inferiore, omnibus spatulato-lanceolatis concoloribus, marginibus subundulatis. Stamina 5 fere limbo breviora, filamentis arcuatis lilacinis. Stylum recto angulo flexum, lilacinum, puncto stigmatoso nudo acuto terminatum; ovarium globosum trilobatum 4 cm. diam. A Griffinia parviflora staminibus sexti abortu constanter 5 et perianthii segmentis concoloribus, a G. Liboniana foliis petiolatis non marmoratis differt.

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Fig. 55. Griffinia Rochae.

Small plant 20 to 25 cm. high. Bulb tunicate, globose, 3 cm. in diameter. Leaves 3 to 4, blade oblong, acute, 10-12 cm. long, 4-5 cm. broad at the middle, bright green latticed by veins crossing the vertical nerves, cuneately narrowed to a channelled petiole 5-6 cm. long. Peduncle compressed, bluntly two-edged, about 20 cm. tall; umbel of 6-8 flowers which nod after fading, spathe persistent, short-acute, 2 cm. long; pedicels short, 1 cm. long, at first straight, then reflexed. Perianth bright lilac, 3 cm. long, the flower distinctly bilabiate by the opposition of the five upper segments to the sixth, lowermost one; tube very small, the segments lanceolate, 2.5 cm. long, 0.5 cm. wide, arcuate, slightly undulate; functional stamens 5, shorter than the perianth, arcuate, anthers linear-oblong; style almost as long as the perianth, bent at a right angle at 3/4 of its height, stigma capitate, minute, ovules 2 in each cell. Chromosome number: 2n = 22.

This plant has been grown easily in a hot house in a mixture of leaf mold, sand, and loam. It flowers from February to April.

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Traub, H. P. and H. N. Moldenke. Amaryllidaceae: Tribe Amarylleae, pp. 152-157. Stanford, 1949.

Contemporary Perennials, by Roderick W. Cumming and Robert E. Lee. 363 pp., with numerous (unnumbered) black-and-white drawings by Allianora Rosse. The Macmillan Company, New York, 1960. $6.95.

This is a most satisfactory reference work on herbaceous perennials, fully trustworthy and up-to-date in nomenclature and variety of plant material included, as well as in cultural advice. It is simple and straightforward enough to be valuable to the greenest amateur, sound and comprehensive enough to satisfy the needs of the greenest-thumbed veteran, except for the specialist in particular plant groups, who will always require his specialized literature, of course.

The first part of the book instructs in planning the garden for perennials, in their planting and maintenance, propagation, and, briefly, in their nomenclature. The second part, the body of the work, includes pointed, succinct observations on more than 560 species of garden perennials, with notes also on the important old and newest cultivars. Based on experience in the northeastern states, the comments are easily modified to apply to other situations. The actual descriptions are limited to a few statements regarding the plants' characteristics of importance to the gardener; there is no precise method for identification intended or attempted. Part 3 includes a list of botanical and common names, a glossary, a tabular guide to outstanding species, and an index.

The sketches showing the general habit of various plants ought to be very helpful; the details of foliage and flowers, however, suffer in definition from Allianora Rosse's over-abundant use of shading and the broken line.

W. J. D.

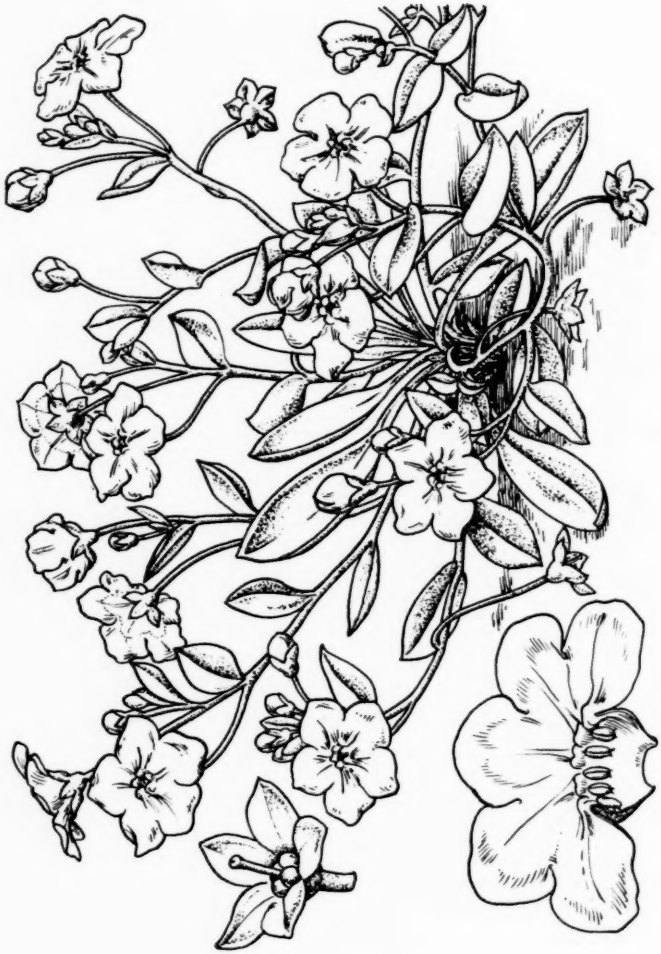

Fig. 56. Omphalodes Luciliae. Redrawn from Curtis's Botanical Magazine 99: t. 6047, 1873.

Studies in the Cultivated Boraginaceae
3. Omphalodes

John Ingram

Although rock gardens no longer hold the prominence in American horticulture which they attained in the 'thirties, there are still those discriminating gardeners who appreciate and enjoy this specialized type of gardening. Many connoisseurs of rock gardens are forever on the lookout for suitable plants, some of which they may have overlooked in the past, or frequently the horticulturalist just has never gotten around to trying certain species, such as Omphalodes verna, which has become an established favorite in many gardens around the world.

The genus Omphalodes was conceived by Tournefort in 1700, but since the International Code of Botanical Nomenclature does not recognize generic and specific names published previous to Linnaeus's Species Plantarum, ed. 1, 1753, his names have no standing in the matter of priority; therefore, Tournefort is not credited with the authorship of Omphalodes. Tournefort originally recognized Omphalodes and Cynoglossum, an obviously related genus, as distinct taxa, but Linnaeus, who adopted many of Tournefort's genera, in this case disagreed with Tournefort's generic concept and chose to combine both genera under Cynoglossum. Two later workers, however, did return to Tournefort's original opinion. The first to do so was Phillip Miller in The Gardeners Dictionary, abridgement of the sixth edition of 1752, volume 2: 1754; this work is unpaged but the entries are arranged alphabetically by genus. Although Miller did not use binomial nomenclature in regard to the species, this does not preclude the use of Omphalodes as a generic name, since an ample description was given. As Druce pointed out in 1913 (Notes on Nomenclature, part II, Supplement to Botanical Exchange Club Report of 1913, 426-436), Miller's 1754 publication was probably overlooked, and as a result Moench (Methodus Plantas Horti Botanici et Agri Marburgensis ... 419, 1794), has been given almost invariably as the author of the genus. Even Brand accepted Moench instead of Miller.

There are estimated to be 24 or 25 species in this genus. In view of the fact that it has been almost forty years since Brand published the last monograph of Omphalodes (in Engler, Das Pflanzenreich 78 (IV. 252): 96-112, 1921), this number of recognized species likely would be altered if a recent revision were undertaken, since it is reasonable to expect that some new information about this interesting group of borages must have accumulated during the intervening years.

Omphalodes grows natively in Mexico, Asia, and Europe, particularly in the Mediterranean region. In spite of the fact that some are native to the New World, none of the Mexican species is currently offered in the trade in the United States; all those available at the present time originally came from Europe and Asia Minor.

All members of the genus are, on sight, recognizable as belonging to the borage family, perhaps immediately reminding one of forget-me-nots, or more likely, the Chinese forget-me-not, Cynoglossum amabile. As is typical of the Boraginaceae, these taxa have a coiled inflorescence which unrolls as it matures, and flowers which approach a true blue. However, Omphalodes linifolia typically has white flowers, and in accordance with the general rule, blue-flowered species can be expected to have white-flowered forms.

Probably, for the majority of gardeners, the common names navelwort or navel-seed, in allusion to the external appearance of the nutlet, are more familiar than the Latin name Omphalodes. The mature fruit in this genus typically comprises four nutlets which are horizontally flattened, with the upper surface concave or cup-shaped, hence the resemblance to an umbilicus and the resulting common names. The nutlets themselves are smooth or hairy but lack the barbed spines which are present on the nutlets of Cynoglossum.

Key to the Cultivated Species of Omphalodes

1. Blade of the basal leaves gradually tapering into the petiole.
   2. Plants annual; leaves linear to narrowly lanceolate, spatulate or oblanceolate; flowers typically white. . . . . O. linifolia
   2. Plants perennial; leaves lanceolate, elliptic to ovate; flowers typically blue.
      3. Stems erect, 3-6 dm. tall, sparsely hairy; leaves hairy on lower surface; sepals densely hairy on both surfaces; margin of the nutlet toothed. . . . . O. lusitanica
      3. Stems spreading, mostly under 2.5 dm. long, essentially glabrous, usually glaucous; sepals glabrous on both surfaces; margin of the nutlet entire. . . . . O. Luciliae
1. Blade of basal leaves definitely basally rounded.
   4. Plants not stoloniferous. . . . . O. cappadocica
   4. Plants stoloniferous. . . . . O. verna

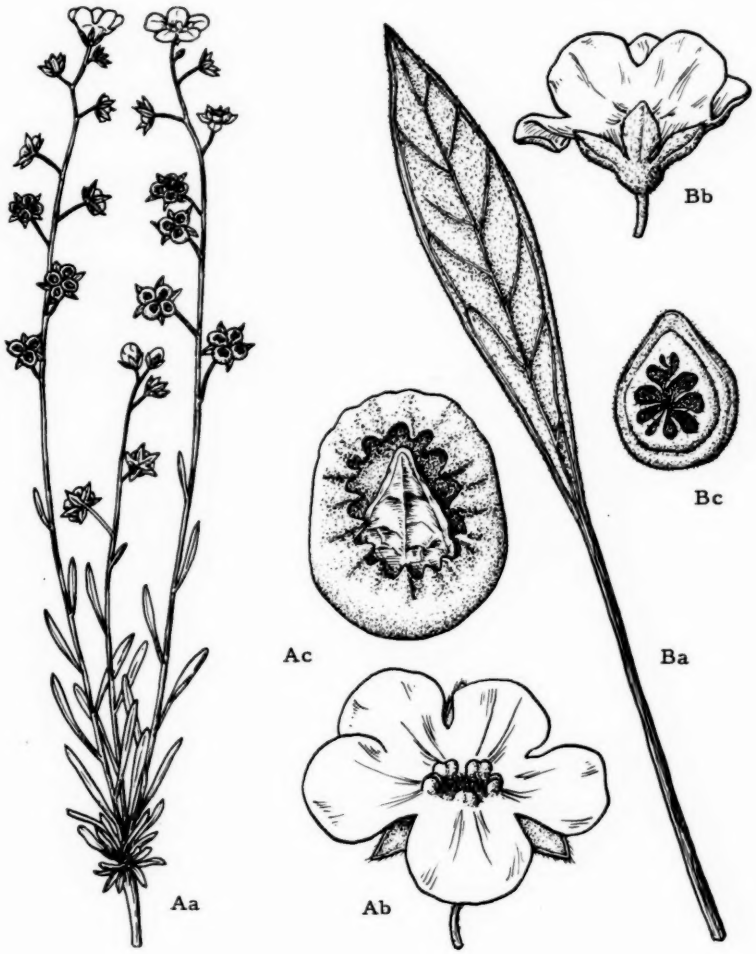

Fig. 57. A, Omphalodes linifolia: a, habit, redrawn from Das Pflanzenreich 78 (IV. 252): fig. 14, 1921; b, flower x 4; c, nutlet x 8. B, Omphalodes lusitanica: a, leaf x 4/5; b, flower x 4; c, nutlet x 8.

Omphalodes linifolia (Linnaeus) Moench, Methodus Plantas Horti Botanici et Agri Marburgensis ... 419, 1794. [Cynoglossum linifolium Linnaeus, Species Plantarum, ed. 1, 134, 1753]. This is the only annual species of this genus cultivated in the United States. It is an erect, almost glabrous species, growing to 3 dm. tall, and flowering in summer and early autumn. It was introduced into cultivation from Spain and Portugal.

Omphalodes lusitanica (Linnaeus) Pourret ex Lange, Pugillus Plantarum imprimis Hispanicarum ... 194, 1864. [Cynoglossum lusitanicum Linnaeus, Species Plantarum, ed. 2, 193, 1762; Omphalodes nitida Hoffmannsegg & Link, Flore Portugaise ... 1: 194, t. 25, 1809]. This is the tallest of the cultivated species, obtaining a height of 6 dm. It is a perennial with blue flowers measuring about

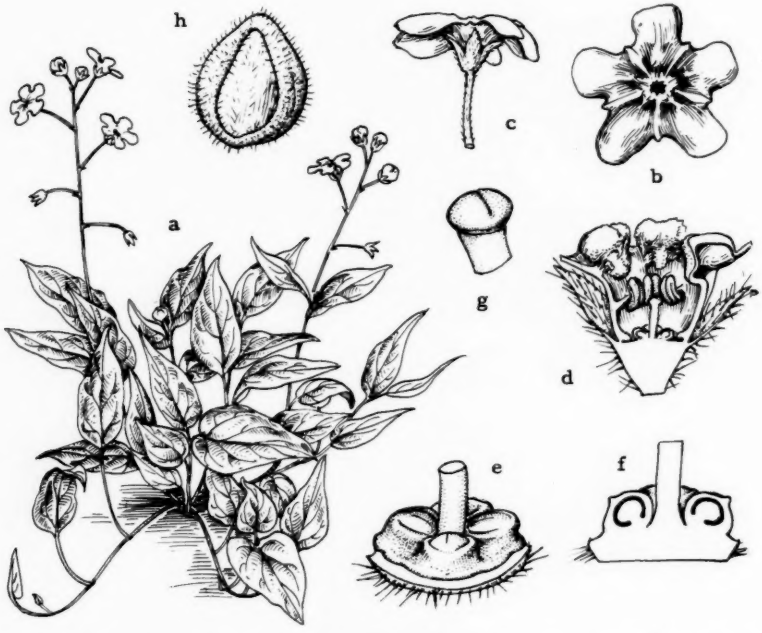

Fig. 58. Omphalodes verna: a, habit x 2/5; b, flower, face view x 1 1/2; c, flower, side view x 1 1/2; d, flower in vertical section (corolla-limb removed) x 6 1/2; e, base of pistil (ovary and base of style) x 16; f, same in vertical section x 16; g, stigma x 24; h, one of the four seed-like nutlets x 6 1/2.

8 mm. across. In the United States it is most frequently offered under a synonym, Omphalodes nitida. It is native to Portugal, and is a spring-flowering species.

Omphalodes Luciliae Boissier, Diagnoses Plantarum Orientalium novarum 1 (fasc. 4): 41, 1844. This is said to be the most difficult member of the genus to grow; however, it makes a charming plant when properly grown. Its flowers, as in the case of certain other borages, open rose and change to blue. It is a glabrous, tufted perennial, with stems up to 2 dm. long, originally coming from Greece and Asia Minor, and flowering in the summer.

Omphalodes cappadocica (Willdenow) de Candolle, Prodromus 10: 161, 1846. [Cynoglossum cappadocicum Willdenow, [Ed.] C. a Linné, Species Plantarum, ed. 4, 1: 767, 1797; Omphalodes cornifolia Lehmann, Magazin der Gesellschaft Naturforschender Freunde zu Berlin ... 8: 97, t. 2, 1818]. This blue-flowered native of Asia Minor is distinguished from the following species by not producing stolons, and by the much more vague character of having longer inflorescences bearing more flowers. It is reported to flower in the springtime.

Omphalodes verna Moench, Methodus Plantas Horti Botanici et Agri Marburgensis ... 420, 1794. Creeping forget-me-not. Omphalodes verna is the most popular cultivated species of this genus. It is easy to grow and forms a large clump, spreading rapidly by stolons, and as its Latin name suggests, flowers in the spring. Although a native of Europe, it has become naturalized in other areas of Europe by escaping from cultivation. The flowers are typically blue and it has been aptly called blue-eyed Mary by Europeans; this name is said to have been given in honor of Marie-Antoinette. A white-flowered form, cv. 'Alba', is also known and offered to horticulturists.

Fig. 59. Achimenes Cettoana: a, habit x 1/2; b, scaly rhizome x 1; c, leaf x 1; d, flower, oblique view x 1; e, flower, face view x 1; f, flower in vertical section x 1 1/2; g, glands from corolla-tube x 20; h, i, anthers, ventral and dorsal views respectively x 5; j, pistil x 2; k, disk x 5; m, ovary in cross-section x 5; n, stigmas x 5; o, fruit (immature) x 1 1/2; p, seed x 20.

Achimenes Cettoana (Gesneriaceae)

Harold E. Moore, Jr.

A handsome Achimenes which grows naturally on mossy rocks in the midst of a small stream close to the Pan-American highway in the Mexican state of Chiapas (Fig. 59) was collected in flower in October, 1959, when most other species, except occasional plants of A. longiflora, were in fruit. Specimens were collected for study and rhizomes for propagation. The latter, as cultivated at Cornell University during 1960, produced plants that reached a height of 3 dm., with erect, sturdy, branching stems and a profusion of showy flowers from early July until late autumn, with some still appearing in early December.

This Achimenes differs substantially from its closest relative and is here described as new, with the epithet Cettoana (set toe ay na) after my friend and field companion, Arq. Max Cetto, and his family. He, his wife Catherine, and daughters Veronica, Ana Maria, and Bettina, have joined me individually and collectively on many field trips and the Cetto home in Jardines del Pedregal, Villa Obregón, D.F. has been a base for botanical operations during several periods of study. It is appropriate that such an ornamental plant from Mexico bear this epithet, for the Cetto home and garden reflect in design and contents the family's love for the countryside and plants of the land which has become their own.

Achimenes Cettoana in the wild state is of smaller proportions than in cultivation. The leaves are narrower, the stems shorter. While charming in its native habitat, the species adapts well to cultivation and promises to be an excellent horticultural subject. Some staking has been found necessary but the general habit is more sturdy and attractive than that of Achimenes longiflora and the rather similar flowers, though somewhat smaller, are more abundant. The discovery and introduction of Achimenes Cettoana were made possible by a grant from the Penrose Fund of the American Philosophical Society for three months of field study of palms and gesneriads in 1959. This assistance is most gratefully acknowledged.

Achimenes Cettoana H. E. Moore, sp. nov.

Ad A. longifloram affinis sed indumento caulium, foliorum, et calycis loborum strigoso, corollae glanduloso-piloso, foliis linearilanceolatis, propagulis elongatis differt.

Scaly rhizomes oblong with loosely arranged scales. Stems erect, to 1 or rarely 2.5 dm. in the wild state, to 3 dm. in cultivation and these robust and much-branched, green flushed with red and densely antrorse-strigose. Leaves dark green, short-petiolate, usually in whorls of 3-4, linear-lanceolate, serrate above the middle, to 5.5 cm. long, 5-7 mm. wide (on type), to 7 cm. long, to 1.3 cm. wide on plants in cultivation, densely strigose above and below on live plants. Flowers solitary in the axils, the green pedicels antrorse-strigose, 5-10 mm. long. Calyx green, the short tube (3 mm. long) and spreading lanceolate lobes (7-12 mm. long) densely strigose. Corolla slightly inclined in the calyx, amethyst violet (R.H.S. Colour Chart 35 and 35/1) to heliotrope (R.H.S. Colour Chart 636) with a pale spot at throat on lower lobe, each lobe with a darker central line, the minutely and sparsely glandular tube scarcely spurred, slender, laterally compressed, ca. 2.5 cm. long, very slightly swollen below at the throat, the limb nearly flat, oblique, with denticulate lobes, the upper of these in living material 15 mm. long, 13-14 mm. wide, the lateral lobes 19 mm. long, 15 mm. wide, the lower 19-20 mm. long, 17 mm. wide, all lengths measured from the throat. Throat laterally compressed, the tube glabrous inside except for a line of minute hairs between the upper lobes. Stamen-filaments white, glabrous, spirally retracted after pollen is shed, anthers pale, united in a rectangle, disk white, undivided, ca. 1 mm. high, crenulately lobed. Ovary green, pilosulous, style white, glandular-pilosulous, stigma white, bilobed. Fruit a capsule ca. 5 mm. long with curved beak 3 mm. long.

MEXICO: Chiapas; on rocks in stream of shaded ravine just below Juarez, near km. 1020 on Tehuantepec-Tuxtla Gutierrez highway, alt. ca. 740 m., 29 Oct. 1959, H. E. Moore, Jr. and Max Cetto 8183 (Type, BH; Isotypes, MEXU, US). Cultivated at Cornell University, Ithaca, N. Y., 11 July 1960, H. E. Moore, Jr. 8183 bis (BH, GH, MEXU, MICH, US).

Achimenes Cettoana belongs in section Achimenes (section Trevirana of Fritsch in Engler & Prantl, Die naturlichen Pflanzenfamilien 4(3b): 175, 1894). It is distinct from other species of this section in several characters though apparently similar to little-known garden plants that were mentioned by Regel (Flora 31: 251, 1848) and described by Hanstein as Achimenes longiflora var. ilicifolia (Linnaea 27: 708, 1856). It is doubtful that authentic material of the latter is extant, and even if it could be proved identical with A. Cettoana, varietal status under A. longiflora is not a satisfactory disposition. The latter species is relatively constant in flower,

leaf-shape, and usually nearly globose small scaly rhizomes throughout its extensive range in Mexico and Central America. The differences among species of the section are summarized in the following key:

1. Corolla-tube conspicuously swollen or prominently spurred at the base, distinctly oblique in the calyx. . . . . Achimenes grandiflora, A. patens

1. Corolla-tube obtuse but scarcely swollen or spurred at the base, straight or only slightly inclined in the calyx.

   2. Flowers scarlet, pink, or rarely white, the corolla-tube 10-12 (-20) mm. long, generally minutely puberulous; calyx-lobes pilosulous. . . . . A. coccinea

   2. Flowers blue-violet or rarely white, the tube more than 2 cm. long.

      3. Stems, pedicels, and calyx-lobes strigose, stems antrorse-strigose; corolla-tube minutely glandular-pilosulous; leaves linear-lanceolate, mostly about 10 times as long as wide; scaly rhizomes elongate, oblong, with loosely arranged scales. . . . . A. Cettoana

      3. Stems and pedicels spreading pilose, the calyx-lobes usually glabrous except the ciliate margins; corolla-tube glabrous; leaves ovate to narrowly elliptic, 3-4 times as long as wide; scaly rhizomes small, globose to ellipsoid, with very tightly arranged scales. . . . . A. longiflora

ADDITIONAL SOURCES OF HERB SEEDS AND PLANTS

To the list of sources published earlier this year in Baileya 8: 10, 11 (1960) may be added the following two sources of seeds. Although the second mentioned is not American, it has a good list, and there are no difficulties or restrictions whatever in connection with ordering and importing herb seeds from Great Britain.

Harry E. Saier, Dimondale, Michigan.
Thompson & Morgan Ltd., Ipswich, England.

Fig. 60. Helianthus × multiflorus, a double-flowered cultivar: a, habit x 1/10; b, median leaf x 1/2; c, head, face view x 1/4; d, head, reverse view, showing involucre x 1/4.

Notes on the Origin of Two Ornamental Sunflowers, Helianthus multiflorus L. and H. laetiflorus Pers.[1]

Charles B. Heiser, Jr.[2]

Although perennial species of Helianthus are occasionally seen in gardens, they are not extensively cultivated in the United States at the present time. Two of the most widely grown are H. multiflorus Linnaeus and H. laetiflorus Persoon, and though not closely related, they share much in common. Helianthus multiflorus is not known in the wild, and H. laetiflorus has a very sporadic distribution in nature. Both were first described from Europe and appear to have originated there through hybridization, although all sunflowers are native to the Americas. Finally, both are propagated from rhizomes rather than seeds.

The first reference to H. multiflorus is in 1591 by Tabernaemontanus with a drawing of "Flos solis minor foemina," and in the following years it was frequently described and figured by herbalists. The fact that the plant does not produce seed was clearly indicated by Morrison in 1699. Philip Miller, in his Gardener's Dictionary, gives a most complete account of the plant, pointing out that it is "a great ornament to gardens within the city" and that the single form was being replaced by the double form. The close relationship to H. decapetalus was early recognized and Asa Gray treated it as a questionable variety of that species.

The hybrid origin for H. multiflorus from H. tuberosus and H. annuus was suggested as early as 1751 by Linnaeus's student, Hartmann, and in 1893 the Rev. C. Wooley Dod pointed out that, since H. multiflorus was always sterile, it might be a hybrid, and suggested that H. annuus, the only sunflower other than H. multiflorus to have double-flowered forms,[3] and H. decapetalus might be the parents.

The present author and Dale M. Smith found that H. multiflorus was a triploid (2n=51), which suggested the possibility of a hybrid origin between a diploid and a tetraploid. A morphological compar-

[1]This article is based largely on two papers, The Origin of Helianthus multiflorus by C. B. Heiser, Jr. and D. M. Smith, Amer. Jour. Bot. vol. 47 (Dec.) 1960, and Helianthus laetiflorus: hybrid or species? by Sarah B. Clevenger and C. B. Heiser, Jr. (unpublished), and has been submitted to Baileya at the request of the editor. Since a complete bibliography is given in these two papers, detailed reference citations are not included here. The research was carried out with the aid of a grant from the National Science Foundation.

[2]Indiana University, Bloomington, Indiana.

[3]The author also has observed double-flowered forms in H. debilis ssp. cucumerifolius (A. Gray) Heiser, and certain perennial sunflowers may produce "double flowers" as the result of insect injury.

ison revealed that in a number of features H. multiflorus is more or less intermediate between H. annuus, a diploid, and H. decapetalus, a tetraploid. Several hybrids have now been secured between various strains of these two species, and while none is identical with H. multiflorus, some of them approach it rather closely, including one which shows double flowers, so it seems reasonable to assume such a hybrid origin for H. multiflorus from spontaneous hybridization in Europe.

One possible objection to the hypothesis is that, though H. annuus, particularly the large monocephalic form, var. macrocarpus (de Candolle) Cockerell, was well established in Europe in 1591 at which time H. multiflorus was known, there is no definite record of H. decapetalus previous to Linnaeus's description in 1753. It could well have been introduced considerably earlier, of course. The alternative hypothesis, that H. multiflorus arose in America from hybridization and that the rhizome was carried to Europe, seems unlikely on several counts, among which is that such a hybrid has never been found in the wild.

Several other interesting problems also arise in connection with H. multiflorus. What type of H. annuus, a highly variable species, served as the original parent? The large head-size in H. multiflorus suggests the possibility that the giant monocephalic form may have been a parent. As mentioned above, this variety was widely cultivated in Europe in the sixteenth century, though thus far it has been impossible for us to effect artificial crosses using this variety. A second question may also be raised. Did H. multiflorus have a single origin or did it arise several times? Bailey lists several varieties of H. multiflorus, most of which relate to the amount of doubleness. Whether the variation results from somatic mutation within a single stock or from different parental stocks is not known. In this connection, Bailey's comments that double forms may revert to single types is of interest. One of the experimental hybrids has the same sort of reversion, but the reverse change, however, has not been reported.

Since the origin of H. multiflorus now seems fairly well established, this knowledge affords opportunities for improving the taxon. Thus far, only yellow-flowered forms are known, but since H. annuus possesses types with both chestnut- and plum-colored rays, it might be possible to create a perennial hybrid with rays of various shades of red through appropriate crosses. The use of other annual species, some of which are much less coarse than H. annuus, as parents in crosses with H. decapetalus or other perennials, also offers possibilities for the creation of new ornamentals. The author has secured hybrids between H. debilis ssp. cucumerfolius, a diploid annual, and H. decapetalus. These triploid hybrids, though single-flowered, are much smaller and more delicate than H. multiflorus. Thus far, they have been grown only one season, but since they do produce rhizomes it is expected that they will persist as perennials.

Helianthus laetiflorus has neither so long nor so colorful a history as H. multiflorus. Apparently the first mention of it is by Lamarck in 1789 from plants grown in France. He, however, used the name H. atrorubens, which is a very distinct and different species, and Persoon in 1807 gave the plant its present name. This rather showy sunflower became widely cultivated throughout Europe in the nineteenth century. Its close relationship to H. rigidus was early recognized and Fernald in 1950 chose to treat the two as varieties of a single species.

The characteristics by which H. laetiflorus differs from H. rigidus—greater height, more leafy peduncles, yellow instead of red disk-florets, the more lanceolate and more acute phyllaries, and the fact that it occasionally bears tubers—all are suggestive of the Jerusalem artichoke, H. tuberosus. These three sunflowers are all hexaploids (n=51).

Hybrids obtained between H. tuberosus and H. rigidus by Dr. Sarah Clevenger were extremely vigorous and rather highly fertile. The hybrids closely resembled H. laetiflorus and would key to that species in manuals. Additional evidence that H. laetiflorus may be of hybrid origin is provided by the fact that where H. laetiflorus has been collected in nature, except in the case of obvious escapes from cultivation, it is found in areas where the two putative parents overlap in distribution.

Although the original plant which was known to Lamarck and Persoon could conceivably represent a natural hybrid introduced into Europe, it seems far more likely that it arose as a spontaneous hybrid in gardens where the two parental species were cultivated. This hypothesis of a hybrid origin suffers from the weakness that, as in the preceding example, one of the supposed parents was unknown at the time H. laetiflorus was first described. Although H. tuberosus was well known in Europe previous to the description of H. laetiflorus, the second putative parent, H. rigidus, was not published in 1818, or nearly thirty years after the first report of H. laetiflorus. It is, of course, quite possible that H. rigidus was cultivated in Europe for a considerable length of time before it was formally recognized. It may have been confused with H. atrorubens, which, like H. rigidus, has reddish disk-florets.

Although H. laetiflorus is capable of setting some seed, in many areas it is barren, probably due to the fact that only a single clone is grown and there are no plants available to serve as a male parent.

Several horticultural forms of H. laetiflorus are known and it is not unlikely that these have had various origins. Some may represent crosses of different types of H. tuberosus and H. rigidus, both of which are variable species. Others may possibly result from F_2 segregates or backcrosses. Neither "H. sparsiflorus" nor "Gullick's variety," the cultigens which are now available in the United States, appear to be F_1 hybrids.

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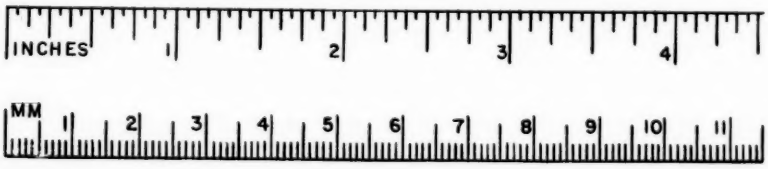
ABBREVIATIONS USED IN BAILEYA

ann.	annual	dm.	decimeter	lf.	leaf
bien.	biennial	fl.	flower	lft.	leaflet
br.	branch	fls.	flowers	lvs.	leaves
brt.	branchlet	flt.	floret	mm.	millimeter
caps.	capsule	fr.	fruit	per.	perennial
cl.	clone	ft.	foot	segm.	segment
cm.	centimeter	hort.	horticultural	st.	stem
cv.	cultivar	in.	inch	sts.	stems
diam.	diameter	infl.	inflorescence	var.	variety

METRIC - ENGLISH EQUIVALENTS (approximate)

6 mm. - 1/4 in.	10 cm. - 4 in.	10 mm. - 1 cm.
12 mm. - 1/2 in.	1 dm. - 4 in.	10 cm. - 1 dm.
25 mm. - 1 in.	3 dm. - 1 ft.	10 dm. - 1 meter
2.5 cm. - 1 in.	10 dm. - 1 yd.	
5 cm. - 2 in.	1 m. - 39 in.